

ENVIRONMENTALLY SUPERIOR WASTE MANAGEMENT TECHNOLOGIES

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Introduction: Discussions and efforts regarding animal waste management practices and the impact of animal agriculture on the environment are at the forefront of issues facing the livestock industry, pork production in particular. In North Carolina, much attention directed at pork production is primarily on “alternatives” to the lagoon/spray field technology. Soil and water quality issues associated with this technology have been identified to be: nutrient loading and fate of nitrogen, phosphorus, and metals (copper and zinc); and, fate of pathogenic bacteria in the manure effluent and air emissions from animal production facilities. Air quality issues identified include emissions of ammonia nitrogen, greenhouse gases, dust and odor. A recent discussion article (North Carolina State University College of Agriculture and Life Sciences, 2000) notes that when properly sited, designed, constructed and managed, lagoon/spray field technology is a reliable method of treating swine wastes; however, evidence in this same article also shows that environmental concerns for the soil, water, and air quality variables noted above need to be critically and objectively examined.

The attention directed to this subject area has resulted in research, development and demonstration efforts by academic institutions, the private sector, as well as the livestock industry. Primary focus has been on various alternatives or modifications to traditional best management practices of animal waste management. A recent report (North Carolina Department of Environment and Natural Resources, 2000), compiled after several months of deliberations by a stakeholder panel, shows that such broad-based efforts are underway not only in North Carolina, but nationally and internationally as well.

On July, 25, 2000 an Agreement was made between the Attorney General of North Carolina and Smithfield Foods, Inc. and its subsidiaries to, in part, provide resources (\$15 million) to North Carolina State University (NCSU) for the development of “Environmentally Superior Technologies” that may serve as alternatives to traditional lagoon/spray field technology. This paper provides a concise overview and discussion for some salient aspects of this research initiative.

Definition of Environmentally Superior Technologies: The Agreement defines “Environmentally Superior Technologies” as “any technology, or combination of technology that (1) is permittable by the appropriate governmental authority; (2) is determined to be technically, operationally, and economically feasible for an identified category or categories of farms and (3) meets the following performance standards:

1. Eliminate the discharge of animal waste to surface waters and groundwater through direct discharge, seepage, or runoff;
2. Substantially eliminate atmospheric emissions of ammonia;
3. Substantially eliminate the emission of odor that is detectable beyond the boundaries of the parcel or tract of land on which the swine farm is located;
4. Substantially eliminate the release of disease-transmitting vectors and airborne pathogens; and
5. Substantially eliminate nutrient and heavy metal contamination of soil and groundwater.”

It is noteworthy that items 1. -5. are verbatim from one section of North Carolina House Bill 1480 intended, in part, to “clarify exceptions to the statewide moratorium” relative to the construction or expansion of swine farms. As such, it is logical to assume that technologies determined to be “environmentally superior” per this Agreement, may also be considered for installation on facilities wishing to expand swine production in North Carolina.

These definitions (items 1.-5.), while comprehensive, are open to broad interpretation and present numerous challenges. The most challenging task may well be the interpretation of “substantially eliminate”. No two stakeholders impacted by pork production are likely to have the same definition of “substantially eliminate” for each of the environmental variables referenced. The final determination, however, of what “substantially eliminate” means quantitatively is likely to be made by the North Carolina Department of Environment and Natural Resources (NCDENR) since the technology, by Agreement definition, must also be “permittable”.

A second concern is valid measurement for some of the environmental variables noted. Performance verification (and any subsequent monitoring for compliance purposes) of odor emissions, ammonia emissions, and disease-transmitting vectors and airborne pathogens present unique challenges. There is currently much scientific debate regarding protocols and methodology for making these measurements. Further, the methodologies utilized for each can be expensive and often represent single-point-in-time determinations. This is an issue for air emissions in particular since it is well established that such emissions can be highly variable within a given day dependent upon many environmental conditions (wind, humidity, temperature, precipitation, etc.) at a farm site.

While these issues are indeed challenging, it is recognized that they must be addressed. To help meet these challenges, it will be critically important for the pork industry, university researchers, NCDENR, and other impacted stakeholders to maintain close communication and engage in professional scientific debate on this subject as new technologies and verification methods are developed, evaluated and demonstrated. As such, the NCSU initiative with this Agreement involves an advisory review panel that is represented by: experienced researchers in the areas of animal waste management and environmental science and public health; NCDENR; environmental and community interest; business management; and, swine agribusiness.

Operational feasibility: There is little debate that one advantage of the lagoon/spray field system is operational simplicity. “Environmentally Superior Technologies” are likely to be more operationally complex and require additional operator skill, training and certification. Operational feasibility may also be interpreted differently for various “category or categories of farms” (described in subsequent section of this paper). The Agreement does not contain a definition of operational feasibility, nor does it contain a listing of factors for consideration in making the determination (as it does for economic feasibility). The history of operational requirements during the performance verification process will be well documented for all technologies studied during this initiative and considered on a case by case basis for operational feasibility prior to making a technology determination for “environmentally superior” status. Factors considered will include technical skill (training and certification) and hours/day required operating and maintaining the technology, technology performance during adverse weather conditions (including but not limited to periods of power outage, excess rainfall, freezing temperatures, etc.).

Economic feasibility: The Agreement is very specific regarding the determination of economic feasibility. The following relevant information must be considered:

1. “The projected 10-year annualized cost (including capital, operation and maintenance costs) of each alternative technology expressed as a cost per 1000 pounds of steady state live weight for each category of farm system;
2. The projected 10-year annualized cost (including capital, operation and maintenance costs) per 1000 pounds of steady state live weight for each category of farm system of a lagoon and sprayfield system that is designed, constructed and operated in accordance with current laws, regulations, and standards, including NRCS design, construction and waste utilization standards;
3. Projected revenues, including income from waste treatment byproduct utilization, together with any costs savings from the new technology;
4. Available cost-share monies or other financial or technical assistance from federal, state or other public sources, including tax incentives or credits, and;

5. The impact that the adoption of alternative technologies may have on the competitiveness of the North Carolina pork industry as compared to the pork industry in other states.”

These are important economic variables and will require considerable effort to determine. The Agreement specifies that an advisory review panel, separate from the panel described earlier, will be involved in evaluating the economic feasibility of the potential alternative technologies. Representation on this panel must include experts in economics from: academia; environmental interest; government; and, the swine industry.

Category or categories of farms: Category(ies) of farm(s) is referenced several times throughout the Agreement. The Agreement specifies that such categories “may be determined based on farm size, geographic location, the geographic concentration of the hog population, the type of farm, and any other factors” deemed appropriate. This is an important determination since some of these variables may significantly impact the economic feasibility of a technology for a given farm category. The Agreement also specifies that all farms covered by the Agreement must be prioritized for conversion to “Environmentally Superior Technologies” based “on appropriate environmental, engineering and operational factors”.

Progress to date and discussion: The following describes activities that have occurred since July 25, 2000 relative to the NCSU research initiative of the Agreement and discussion regarding the next 18 months of the initiative.

Both advisory review panels have been appointed. A total of 21 members make up both panels (the economic panel is made up of 5 individuals).

The initial 5 technologies for “installation beginning immediately” per the Agreement have been selected. Those selections were based primarily on work previously conducted through NSCU CALS programs for each of the technologies (Williams, 2000). The technology teams for these 5 systems have made presentations and provided documents to the advisory review panels as well as responded to questions and concerns voiced by these panels. A general description for these technologies are: 1) a covered in-ground ambient anaerobic digester; 2) an upflow biofiltration system; 3) a sequencing batch reactor process; 4) constructed wetlands treatment; and 5) high temperature anaerobic digestion. Systems 1 and 4 are installed on commercial swine farms in North Carolina in Johnston and Onslow counties, respectively. Tentative sites have been identified for each of the 3 additional technologies. Plans are for all 5 to be operational by summer 2001.

The Agreement specifies that an additional 5-6 technologies will be selected for performance verification by early 2001. In response to a request for proposals issued by NCSU in September 2000, approximately 100 technology suppliers applied for consideration. Over 30 professionals from have competitively reviewed those proposals across the U.S. It is anticipated that, based on those reviews, and review and recommendation by the advisory review panels, that an additional 5-6 (perhaps more, depending upon budgetary restraints) will be selected by early 2001. Again, it is planned

that these systems will be operational on farms and ready for performance verification by summer 2001.

These projected deadlines are aggressive. The Agreement, however, specifies that a report is due by July 25, 2002 which contains “(1) a finding that a technology or combination of technologies is an Environmentally Superior Technology or Technologies; (2) an identification of the category or categories of farms covered by the determination; (3) a determination (made in consultation with DENR) that the technology or technologies are capable of being permitted by DENR and any other appropriate governmental authority; and (4) a schedule for implementation of the Environmentally Superior Technology or Technologies as soon as possible”. It is essential for everyone that is involved and/or impacted by this initiative, including pork producers, the animal agriculture industry, environmental groups, neighbors to animal operations, regulatory agencies, elected officials, university researchers, technology suppliers, etc., to recognize that many complex tasks must be accomplished prior to issuing this report. As described in this paper, these tasks will involve not only development and verification of new waste treatment technologies but also development and verification of new environmental parameter measurement methodologies as well. Consideration and review of potential technologies must be comprehensive and well justified such that resources (human and financial) are not wasted. The tasks will involve major construction projects with necessary permit procurement. And finally, the performance verifications must be subjected to valid scientific methodology including replication of data under stringent conditions of quality assurance and quality control. While every effort will be made to meet the deliverables described in the Agreement to identify “Environmentally Superior Technologies”, the stakes are too high for everyone that is involved and/or impacted by this initiative for short cuts to be taken or premature decisions to be made relative to any of these described tasks.

References:

North Carolina Department of Environment and Natural Resources. 2000. Framework for the conversion of anaerobic lagoons and sprayfields - technology panel final report. Published by North Carolina Department of Environment and Natural Resources; contact Dennis Ramsey.

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